The Empirical Research on the Relationship between Fixed Assets Investment and Economic Growth

—A Case in Shaanxi Province of China

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Abstract

There is big regional difference between fixed assets investment and economic growth. This article uses Eviews 6.0 software to analyze the relationship between the two parts through establishing vector auto-regressive model, and the impulse response function and variance decomposition method, using related statistical data, empirical research on the relationship between the fixed assets investment and economic growth in Shaanxi province of china. It comes to the conclusion that the promoting effect of economic growth on fixed assets investment is greater than that on economic growth in Shaanxi province, and as well some relevant conclusions.

Keywords

Fixed Assets Investment; Economic Growth; Vector Auto-Regressive Model

Introduction

Keynes' multiplier---acceleration principle shows that investment has multiplier effect on the economic growth, that has accelerating effect on investment. Investment is an important factor for regional economic growth, and fixed assets investment occupies a large proportion of investment. Regional economic growth can accelerate capital accumulation, and further expand the fixed assets investment.

Throughout academia's research on the relationship between fixed assets investment and economic growth, it has been found that regional research results were different. From national perspective, Yue Junjiang (2013) through researching China's major cities and regions found that different regional development foundations lead to different relationship between two parts; Zheng Siqi and Liu Hongyu (2004) argued that construction investment influenced the development of China's economy in the short term, but economic development has long-term effects on the investment. From regional perspective, He Chuanchao (2011) argued that fixed assets investment and economic growth promoted each other in Guangdong province, and others hold the same viewpoints, for example, Lei Yang, Zhang jie and so on; in addition, Sheng Rui (2012) found that fixed assets investment promoted the local economic development in Yulin, Tun Xingxia, Wang Dongzhu and Zhong Fei, De Long Summers and others have the same viewpoints. However, Duan Hongxia (2011) argued that fixed assets investment has weak effect on economic growth in Hebei province; Hu Po (2011) claimed that economic growth promoted the fixed assets investment in Anhui province. Thus in different regions and at different times, the relationship between the fixed assets investment and economic growth tends to be diversified. Judging from the present main research results, it is observed that related research is little in Shaanxi province.

According to statistics, fixed assets investment (expressed by fixed assets investment) in Shaanxi province increases from 372 billion in 1996 to 10023.53 billion in 2011, increasing nearly 27 times; at the same time, economic growth(expressed by gross domestic product)has increased from 1215.84 billion in 1996 to 12512.3 billion in 2011, increasing more than 10 times. Well then, it is examined whether there is a long-term stable equilibrium relationship between fixed assets investment and economic growth or not, and whether it is one-way promoting relationship or each other. This article selects relevant data of 1996 to 2011 in Shaanxi Province, and makes an empirical analysis on the relationship between the two parts.

Empirical Analysis

Data

In this paper, the selected data are derived from

statistical yearbook of Shaanxi province from 1997 to 2012, in order to make results more reasonable and accurate, we separately logarithm processing on fixed assets investment (fi) and gross domestic product (GDP),with the aid of Eviews 6.0, then data analysis process. The data is listed in TABLE 1:

TABLE 1 DATA TABLE OF FIXED ASSETS INVESTMENT AND GROSS DOMESTIC PRODUCT

Year	Fi（billion）	Gdp（billion）	Lnfi	Lngdp
1996	372	1215.84	5.918894	7.10319
1997	424.1	1363.6	6.049969	7.217884
1998	544.89	1458.4	6.300584	7.285095
1999	619.27	1592.64	6.428541	7.373148
2000	745.85	1804	6.614525	7.497762
2001	850.66	2010.62	6.746013	7.606198
2002	974.63	2253.39	6.882058	7.720191
2003	1278.72	2587.72	7.153615	7.858532
2004	1544.19	3175.58	7.342255	8.063246
2005	1982.04	3933.72	7.591882	8.277341
2006	2610.22	4743.61	7.86719	8.464554
2007	3642.13	5757.29	8.200324	8.658222
2008	4851.41	7314.58	8.487025	8.897625
2009	6553.39	8169.8	8.787738	9.0082
2010	8561.24	10123.48	9.055	9.222613
2011	10023.53	12512.3	9.212691	9.434467

Data source:《Shaanxi Statistical Yearbook》(1997-2012), China Statistical Press

Stationarity Test and Cointegration Test

When analyzing the time series data, first of all, stationarity of data should be tested, in order to prevent the spurious regression phenomenon, impact analysis results. Stationarity test involves a variety of methods, such as scatter plot test, unit root test and so on. among which this article selects the more common unit root test to analyze the stationarity of sample data. The test results are shown in table 2:

TABLE 2 STATIONARITY TEST

Variables	ADF Test Statistics	The Critical Value of Significance Level			Test Results
		1%	5%	10%	
lnfi	-3.1	-4.99	-3.88	-3.39	non-stationary
lngdp	-1.41	-4.73	-3.76	-3.32	non-stationary
D(lnfi)	-2.58	-4.8	-3.79	-3.34	non-stationary
D(lngdp)	-3.58	-4.8	-3.79	-3.34	non-stationary
D(D(lnfi))	-5.83	-4.89	-3.83	-3.36	stationary
D(D(lngdp))	-4.05	-4.99	-3.88	-3.39	stationary

It can be seen from TABLE 2 that each variable original sequence values are greater than the critical values of the significance level, so the time series data are non-stationary, thus we need to examine the differential sequences, and the results show that under the significance level of 5% and 10%, its ADF test values of corresponding second-order differential sequences are smaller than the critical values, so the second-order differential sequences are stationary. Therefore, it can be concluded that fixed assets investment and gross domestic product are I (2) sequences, and probably, there is a cointegration relationship between them that should be investigated further.

Cointegration test is mainly to test long-term stable equilibrium relationship between two variables, which is necessary for further analysis. At present, the cointegration test has two common used methods, one of which is based on the regression residuals to examine whether residual sequence is stationary or not via CRDW, DF and ADF, if it is, then there is a long-term stable equilibrium relationship, otherwise, there isn't; while the other is based on the regression coefficients, such as the Johansen cointegration test, a test regression coefficient method based on vector autoregression model, which is common used to test cointegration relationship between multivariate variables, as it does not need linear regression between the variables in advance, so the application is more convenient. This article adopts the first method which is based on the regression residuals. First of all, regression equation $lngdp=C_1+C_2lnfi+u_t$ is established, and then the relationship between the fixed assets investment and gross domestic product is obtained by the least squares method, and the relationship as follows:

$$lngdp=2.88+0.7\ lnfi+u_t \quad (1)$$

It can be observed that $R^2=0.996$, D.W.=1.44, visibly, regression effect is better. Next, the stationarity of residual sequence is tested, and test results are shown in table 3:

TABLE 3 THE STATIONARITY OF RESIDUAL SEQUENCE

Variables	ADF Test Statistics	The Critical Value of Significance Level			Test Results
		1%	5%	10%	
u_t	-2.98	-2.73	-1.97	-1.61	stationary

It can be seen from table 3 that the ADF test value of residual sequence is less than the critical values of 1%, 5% and 10%, thus the residual sequence is stationary, and there is long-term stable equilibrium relationship between fixed assets investment and economic growth.

The Establishment of Vector Auto-Regressive Model

Vector auto-regressive (VAR) model is based on stationary time sequences or cointegration relationship sequences, so a VAR model can be developed between fixed assets investment and economic growth. According to the AIC and SC criteria (see table 4), variable lag first-order is selected to establish vector auto-regression model.

TABLE 4 SELECTION TABLE OF VAR MODEL LAG ORDER

lag	LogL	LR	FPE	AIC	SC	HQ
0	6.742145	NA	0.001742	-0.677449	-0.586155	-0.685900
1	51.91413	70.98455*	4.92e-06*	-6.559162*	-6.285280*	-6.584515*
2	54.91014	3.852004	5.99e-06	-6.415734	-5.959264	-6.457988

By establishing the VAR model, we get the relationship between the fixed asset investment and gross domestic product, as follows:

$$lngdp=0.32+0.85lngdp(-1)+0.15lnfi(-1) \quad (2)$$

$$lnfi=-2.61+0.86lngdp(-1)+0.43lnfi(-1) \quad (3)$$

(2) and (3) adjusted model-fitting degrees are all 0.997, and visibly model fitting is good. Meanwhile, it is evident that when the gross domestic product of the previous period increases 1%, this period gross domestic product and fixed assets investment increase respectively 0.85% and 0.86%; while when the fixed assets investment of the previous period increased 1%, this period gross domestic product and fixed assets investment increase respectively 0.15% and 0.43%. Visibly, fixed assets investment and economic growth promote each other, and the promoting effect of economic growth in previous period on fixed assets investment in this period is greater than that on economic growth in this period.

Impulse Response Function

Impulse response function reflects the degree and change trend of another variable when one variable sagittal impact is given in this paper; and based on the VAR model, the impulse response function diagram of the fixed assets investment and economic growth are drawn, which is shown in figure 1 and figure 2, in which the real line part is the real value of impulse response function, and the dashed line part is the value of real value plus or minus two standard deviations.

It can be seen from figure 1 that when fixed assets investment is assigned with a positive impact, the gross domestic product shows rising trend, and the increment is significant. The average growth rate is 0.73%, indicating that investment multiplier effect is stronger. The constant increasing fixed assets investment promotes sustained economic growth in Shaanxi province, resulting from the improvement of the technology equipment and production conditions, which is not only useful for enterprises to improve production efficiency and market competitiveness, but also promoting economic structure adjustment and industrial upgrading, building economic sustainable development platform.

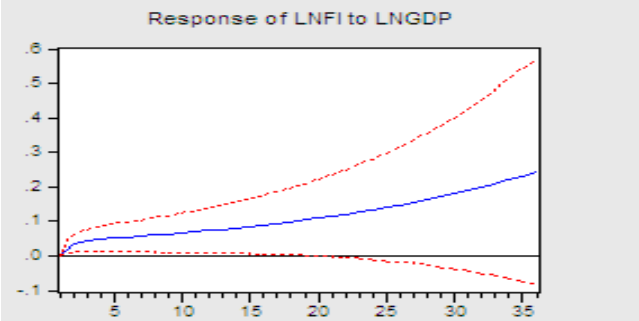

FIG. 1 IMPULSE RESPONSE FUNCTION OF FIXED ASSETS INVESTMENT TO ECONOMIC GROWTH

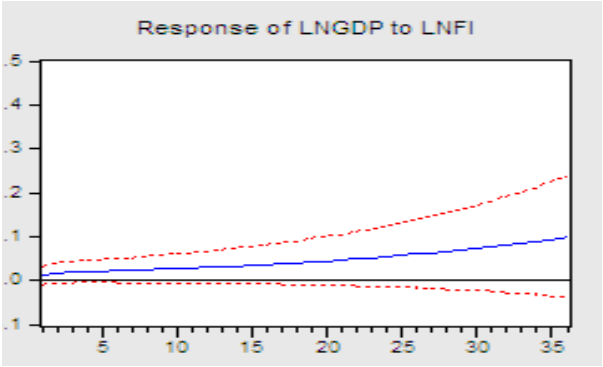

FIG. 2 IMPULSE RESPONSE FUNCTION OF ECONOMIC GROWTH TO FIXED ASSETS INVESTMENT

It can be observed from figure 2 that when gross domestic product embodies a positive impact, fixed assets investment also shows rising trend year by year and the operational time limit is longer, but increasing amplitude is smaller, and the average growth rate is 0.14%, indicating that national income growth has a weak accelerating effect on investment in Shaanxi province. As economic growth plays a pulling function role in fixed assets investment, therefore, to accelerate economy of Shaanxi province, the soft and hard environment of investment should further be perfected, so as to attract more and more enterprises to invest fixed assets, thus forming the virtuous cycle of economic growth- investment- economic growth, promoting sustained economic development in Shaanxi province.

Variance Decomposition Analysis

Variance decomposition analysis is conducted to describe the contribution degree of each variable to the model endogenous variable, and it can be concluded that the effect size of the independent variable on the dependent variable in this paper, and the contribution degree of the fixed assets investment and gross domestic product to its own and each other are analyzed. Variance decomposition analysis results are shown in table 5 and table 6:

TABLE 5 VARIANCE DECOMPOSITION ANALYSIS RESULTS OF LNFI

Period	S.E.	Lnfi	Lngdp
1	0.052159	100.0000	0.000000
2	0.070202	75.13366	24.86634
3	0.087662	58.19461	41.80539
4	0.104066	48.53348	51.46652
5	0.119709	42.61982	57.38018
6	0.134927	38.69886	61.30114
7	0.149966	35.93138	64.06862
8	0.165003	33.88480	66.11520
9	0.180170	32.31732	67.68268
10	0.195570	31.08396	68.91604

It is evident from table 5 that with the increasing time, the role of economic growth in fixed assets investment is more and more obvious, but the role of fixed assets in its own is more and more weak, and in the fourth stage, the contribution rate of economic growth to fixed assets is more significant than its own contribution degree, playing a dominant role, visibly, economic growth promotes fixed assets investment.

TABLE 6 VARIANCE DECOMPOSITION ANALYSIS RESULTS OF LNGDP

Period	S.E.	Lnfi	Lngdp
1	0.041337	6.362929	93.63707
2	0.055929	12.11333	87.88667
3	0.067930	15.62546	84.37454
4	0.078991	17.78572	82.21428
5	0.089621	19.19761	80.80239
6	0.100059	20.17786	79.82214
7	0.110455	20.89264	79.10736
8	0.120910	21.43402	78.56598
9	0.131502	21.85625	78.14375
10	0.142296	22.19323	77.80677

It can be seen from table 6 that with the increasing time, the role of fixed assets investment in economic growth is more and more obvious, but the role of economic growth to its own is more and more weak, however, the contribution degree is still much higher, visibly, the contribution level of fixed assets to economic growth is relatively small, thus regional economic growth can be promoted through other ways.

Conclusion and Discussion

These analyses further verify Keynes' multiplier-acceleration principle which proposes that fixed assets investment and economic growth promote each other, but when combining with regional economic development data in Shaanxi province, the relationship between the two parts presents its features and regularity.

Conclusion

(1) Empirical analysis shows that in the 15 years from 1996 to 2011, the fixed assets investment and economic growth promote and influence each other in Shaanxi province, and there is long-term stable equilibrium relationship between the two parts, but the mutual influence degree is different.

(2) The increasing fixed assets investment promotes a strong increasing trend of the gross domestic product in Shaanxi, the average growth rate reached 0.73%, indicating that investment multiplier effect is stronger.

(3) The growth of the gross domestic product promotes an increasing trend of the fixed assets investment year by year in Shaanxi, and the operational time limit is longer, but increasing amplitude is smaller, the average growth rate is only 0.14% implying that national income growth has a weak accelerating effect on investment in Shaanxi province.

(4) Judged in a long-term and dynamic way, the role of economic growth in fixed assets investment is more and more obvious, but the role of fixed assets in its own is more and more weak, and in the fourth stage, the contribution rate of economic growth to fixed assets is more significant than its own contribution degree.

(5) Judged in a long-term and dynamic way, the promoting role of fixed assets investment in economic growth is more and more obvious, but the role of economic growth to its own is more and more weak, however, the contribution degree is still much higher.

(6) The area economy in Shaanxi province is developed when put into China's economic landscape, the increasing fixed assets investment boosts significantly industrialization and economic growth in Shaanxi, although macroeconomic situation faces downward pressure in China, it is still contrarian growth and double-digit growth rate is maintained, economic growth in Shaanxi is in a rising channel, and advantage of backwardness is obvious.

Discussion

In the initial and mid-term stage of industrialization, investment activity including fixed assets investment is the original force of the economic growth, but due to

the global economic crisis and economic structural adjustment in China, investment and growth face new challenges in Shaanxi.

First of all, equipment investment proportion is larger in Shaanxi province, such as coal industry whose pulling function for economy is very strong, but with the third global industrial revolution-the green energy revolution and industrial structure upgrade in China, the demand for polluting energy is declining, such as coal, in addition economic growth needs to adjust the structure of fixed assets investment in Shaanxi province.

Secondly, economic development rely on investment as well as consumption, thus full play should be given to the residents' consumption effect on pulling economic growth, at the same time, the increasing residents' consumption level can also stimulate the increasing investment, thereby promoting economic growth. At present, the consumption level of Shaanxi and the national people is low, which only accounts for 50% of GDP and has a very large growth space. Therefore, expanding domestic demand and improving people's livelihood is preference choice to promote sustainable development of economic in Shaanxi.

Thirdly, mutual promoting relationship between fixed assets investment and economic growth has the law that marginal utility decreases successively, in addition to optimizing continuously the structure of fixed assets investment, the human capital investment should expand moderately with aim to meet the need of technological progress and technological innovation, perhaps it is the key to improving the quality of economic development in Shaanxi.

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